



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/776,073	02/01/2001	Fuyun Ling	010096	9452
23696	7590	04/08/2004	EXAMINER	
Qualcomm Incorporated Patents Department 5775 Morehouse Drive San Diego, CA 92121-1714			VARTANIAN, HARRY	
			ART UNIT	PAPER NUMBER
			2634	
			DATE MAILED: 04/08/2004	

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/776,073

Applicant(s)

LING ET AL.

Examiner

Harry Vartanian

Art Unit

2634

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 February 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 February 2001 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 5.6.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

Art Unit: 2634

Detailed Action

Specification

1. The disclosure is objected to because of the following informalities: On pg 23, lines 19-23 it is disclosed that modulators are 114a...114t. The correct label for the modulators in fig 1 are 122a...122t.

Appropriate correction is required.

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "124r" in figure 1 has been used to designate both a receiving and transmitting antenna. ***Please change 124r to 152r.*** A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: 714, 722, 732, 724, 734, 736. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Art Unit: 2634

Claims 1, 35 and 36 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. More specifically, the phrase:

"puncturing the plurality of coded bits in accordance with a particular puncturing scheme to provide a number of unpunctured coded bits"

is unclear since how can puncturing a code "provide" unpunctured bits? Please clarify.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1, 3, 14-15, 24-25, 27-29 and 32-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (US 20020119781 A1) in view of Hammons Jr (Us Patent 6,601,214). Regarding Claim 1, Li et al meets the following limitations:

In a wireless communication system, a method for preparing data for transmission on a plurality of transmission channels(**title**), wherein each transmission channel is operative to transmit a respective sequence of modulation symbols, the method comprising:

determining a number of information bits per modulation symbol supported by each transmission channel;
Para 0026, 0048-0051; Table 1

Art Unit: 2634

identifying a modulation scheme for each transmission channel such that the determined number of information bits per modulation symbol is supported; **Para 0026, 0048-0051**

determining a coding rate for each transmission channel based at least on the determined number of information bits per modulation symbol and the identified modulation scheme for the transmission channel, **Para 0026, 0048-0051**

wherein at least two transmission channels are associated with different coding rates; **Para 0026, 0048-0051**

encoding a plurality of information bits in accordance with a particular encoding scheme to provide a plurality of coded bits; **Para 0026, 0048-0051**

Li fails to teach the puncturing steps described in Claim 1.

However, Hammons Jr et al meets the following limitations of the Claim:

puncturing the plurality of coded bits in accordance with a particular puncturing scheme to provide a number of unpunctured coded bits for the plurality of transmission channels; **(Column 1, Lines 46 to Column 2, Line 20)**

adjusting the puncturing to achieve the different coding rates for the at least two transmission channels. **(Column 1, Lines 46 to Column 2, Line 20) Claim 8;**

Therefor it would have been prima facie obvious at the time the invention was made for Li et al's OFDMA system to use puncturing in order to adjust the coding rates. The motivation to combine is disclosed by Hammons Jr where he describes that the need for puncturing is "Due to data capacity limitations that may be present in certain communications networks, it is often necessary to decrease the rate and hence, the length, of a rate encoded data stream." (Column 1, Lines 46-51) Hammons Jr proceeds by describing how adaptive puncturing can be used for rate adjustment.

Regarding Claim 3, Li et al meets the following limitations:

wherein the wireless communication system is an orthogonal frequency division modulation (OFDM) communication system.**(title)**

Regarding Claim 14, Hammons Jr meets the following limitations:

wherein the encoding is achieved via a Turbo code. **Abstract**

Regarding Claim 15, Hammons Jr meets the following limitations:

wherein the encoding provides a plurality of tail and parity bits for the plurality of information bits, and wherein the puncturing is performed on the plurality of tail and parity bits. **Abstract**

Regarding Claim 24, Hammons Jr meets the following limitations:

Art Unit: 2634

interleaving the plurality of coded bits. **(Column 8, Lines 34-45)**

Regarding Claim 25, Hammons Jr meets the following limitations of the Claims:

wherein the puncturing is performed on interleaved coded bits. **fig 1**

Regarding Claim 27, Li et al meets the limitations of the as they state that the unpunctured information bit stream is mapped to a symbol of one the modulation schemes listed in table 1.

Regarding Claim 28, Hammons Jr meets the following limitations of the Claims:

interleaving the plurality of coded bits, and wherein the non-binary symbols are formed from the interleaved coded bits. **Fig 1;**

Moreover, concerning the rejection for Claim 28, it would have been obvious for mapping symbols after the codes had been interleaved, since in OSI communication stack modulation(layer 1) is done after coding(layer 2).

Regarding Claim 29, it is well known in the art that a constellation is inherently associated with a modulation scheme, like 16 QAM. Therefor Li et al implicitly meets this limita tion.

Regarding Claim 32, Li et al meets the following limitations:

adapting to changes in the plurality of transmission channels by repeating the determining the number of information bits per modulation symbol, the identifying the modulation scheme, and the determining the coding rate. **Para 0026, 0048-0051**

Regarding Claim 33, Li et al meets the following limitations:

wherein the modulation scheme for each transmission channel supports transmission of two or more coded bits per modulation symbol. **table 1**

Regarding Claim 34, Li et al meets the following limitations:

wherein the transmission on the plurality of transmission channels are intended for a single recipient receiving device. **Para 0900**

4. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (US 20020119781 A1) in view of Hammons Jr (Us Patent 6,601,214) further in view of

Art Unit: 2634

Greenwood et al(US PAT #6,598,200). Li et al and Hammons Jr meet all the limitations of the Claim 22 except disclosing the use padding bits in OFDM.

However, Greenwood et al meets the following limitation of the Claim:

inserting padding bits to fill available but unfilled bit positions in the plurality of transmission channels.
Claim 1

Therefor it would have been prima facie obvious at the time the invention was made for Li et al's OFDMA system in combination with Hammons Jr to use padding bits. A motivation to combine is disclosed by Riazi et al (US Pat# 6618367):

"The 366 bits of zero-padding for each program cluster is needed in order to have an integral number of OFDM symbols and TDM bursts per cluster."

5. Claims 30-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (US 20020119781 A1) in view of Hammons Jr (Us Patent 6,601,214) further in view of Schramm (US PAT #5,812,601). Li et al and Hammons Jr meet all the limitations of the Claims 30-31 except disclosing the use of gray codes in their encoders.

However, Schramm meets the limitations of the Claims in fig 2a and 2b by disclosing a QAM constellation using gray codes. Therefor it would have been prima facie obvious at the time the invention was made for Li et al's OFDMA system in combination with Hammons Jr to use gray codes. A motivation to combine is disclosed by Schramm in that gray codes can save power. More specifically he states:

"For example, convolutional codes were designed in order to achieve maximum free Hamming distance. For 2PSK and 4PSK with Gray mapping, this approach leads to communication systems with maximum power efficiency."
(Column 3, Lines 5-9)

6. Claims 2, 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (US 20020119781 A1) in view of Hammons Jr (Us Patent 6,601,214) further in view of Wu et al (US 20020122383 A1). Regarding Claim 2, Li et al and Hammons Jr meet all the limitations of the Claim except disclosing the using of MIMO stage in their OFDM communication system.

Art Unit: 2634

However, Wu et al meets the following limitations:

wherein the wireless communication system is a multiple-input multiple-output (MIMO) system with a plurality of transmit antennas and a plurality of receive antennas. **Abstract**

Therefor it would have been prima facie obvious at the time the invention was made for Li et al's OFDMA system in combination with Hammons Jr to use a MIMO stage. The motivation to combine is disclosed by Wu et al:

"The MIMO structure may be used for carrying out time diversity for an OFDM system. For instance, when one transmitter transmits an OFDM signal, another transmitter will transmit a fully correlated OFDM signal to that transmitted by the one transmitter. The same OFDM signal is transmitted with, for instance, a fixed OFDM duration." **Para 0010**

Regarding Claim 4, the rejection above also applies here since Wu et al discloses that their MIMO stage be used in an OFDM system.

Regarding Claim 5, Wu et al meets the following limitations of the Claim:

wherein the OFDM system is operative to transmit data on a plurality of frequency subchannels, and wherein each transmission channel corresponds to a spatial subchannel of a frequency subchannel in the OFDM system. **Abstract**

7. Claims 6-9, 11-12, 20-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (US 20020119781 A1) in view of Hammons Jr (Us Patent 6,601,214) further in view of Kroeger et al(Us Patent# 6,345,377). Regarding Claim 6, Li et al and Hammons Jr meet all the limitations of the Claim except disclosing that "the puncturing is based on transmission capabilities".

However, Kroeger et al met the following limitations:

wherein the puncturing is based on transmission capabilities of the plurality of transmission channels. **(Column 4, Line 66 to Column 5, Line 24)**

Therefor it would have been prima facie obvious at the time the invention was made for Li et al's OFDMA system in combination with Hammons Jr to have the puncturing based on transmission capabilities. The motivation to combine is disclosed by Kroeger et al:

Art Unit: 2634

"OFDM transmission is unique in this respect where knowledge through estimation of non-uniform (nonwhite) interference or noise can be used to adaptively improve FEC decoder performance." (**Column 5, Lines 20-24**)

Therefor, it is advantageous to estimate interference and noise to determine the proper forward error coding technique and coding rate, which puncturing is related to.

Regarding Claim 7, Li et al meets the following limitations:

wherein the transmission capabilities are determined from channel state information (CSI) derived for the plurality of transmission channels. **Para 52-56**

Regarding Claim 8, Li et al meets the following limitations:

wherein the CSI includes signal-to-noise ratio (SNR) information for the plurality of transmission channels. **Para 52-56 Note: each cluster is a group of channels. Therefor sending information of different clusters covers the scope of sending information for each subcarrier channel**

Regarding Claim 9, Li et al meets the following limitations:

wherein the CSI includes information related to transmission characteristics from transmit antennas to the receive antennas. **Para 52-56 Note: this is what the pilot signal is used for.**

Regarding Claim 11, Kroeger et al meets the following limitations:

grouping transmission channels having similar transmission capabilities to segments, and wherein the puncturing is performed for each segment. (**Column 4, Line 66 to Column 5, Line 24**)

Regarding Claim 12, it would have been obvious that once the subcarrier(s) is(are) divided as described by Kroeger, each segment would be assigned some kind of code. This is an inherent feature in OFDM that is implied by Li et al and Kroeger.

Regarding Claim 20, Kroeger et al meets the following limitations:

wherein the encoding is achieved via a convolutional code. **fig 2**

Regarding Claim 21, Kroeger et al meets the following limitations:

wherein the encoding is achieved via a block code. **fig 6 and 6a**

8. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (US 20020119781 A1) in view of Hammons Jr (Us Patent 6,601,214). Arranging the segments

Art Unit: 2634

of transmission channels based on a range of SNR is a design choice. Therefor it would have been prima facie obvious base channel selection on a certain SNR range.

9. Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (US 20020119781 A1) in view of Hammons Jr (Us Patent 6,601,214) in view of Doetsch et al (US Patent #6,571,366). Regarding Claims 18 and 19, Li et al and Hammons Jr meet all the limitations of the Claim except disclosing the exact code rate selection.

However, Doetsch et al meets the following limitations of the Claims:

wherein the coding rate for each transmission channel is selected to be between, and inclusive of, $n/(n+1)$ and $n/(n+2)$, where n is the number of information bits per modulation symbol supported by the transmission channel. **(Column 6, Lines 37 to Column 7, Line 14)**

wherein the coding rate for each transmission channel is $1/2$ or higher. **(Column 6, Lines 37 to Column 7, Line 14)**

Therefor it would have been prima facie obvious at the time the invention was made for Li et al's OFDMA system in combination with Hammons Jr to have certain restrictions on the coding rate. The motivation to combine is that different modulation schemes have varying code rate requirements (please see Hammons Jr Column 1, Line 46 to Column 2, Line 16 for code rate adjustment).

10. Claims 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (US 20020119781 A1) in view of Hammons Jr (Us Patent 6,601,214) in view of Li (US Patent #6,519,732). Li et al and Hammons Jr meet all the limitations of the Claim except describing the turbo encoder using two separate interleavers.

However, Li meets the following limitation

wherein the encoding is achieved via a Turbo code comprised of two constituent codes, and wherein the plurality of information bits, a plurality of tail and parity bits from a first constituent code, and a plurality of tail and parity bits from a second constituent code are separately interleaved. **Fig 18 and 20**

Art Unit: 2634

Therefor it would have been prima facie obvious at the time the invention was made for Li et al's OFDMA system in combination with Hammons Jr to separately interleave two turbo codes. The motivation to combine is stated by Li "An interleaver randomizes the source data provided from one of the convolution units." at which forth it would be advantageous to have two independently interleaved turbo codes.

10. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (US 20020119781 A1) in view of Hammons Jr (Us Patent 6,601,214). The limitations of this rejection were met in the paragraphs above by rejection of Claims 1, and 27.

11. Claims 36-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (US 20020119781 A1) in view of Hammons Jr (Us Patent 6,601,214). Regarding Claim 36, Li et al meets the following limitations of the Claim:

A wireless communication system operative to transmit data on a plurality of transmission channels, wherein each transmission channel is used to transmit a respective sequence of modulation symbols, the system comprising **Para 0001**

an encoder configured to encode a plurality of information bits in accordance with a particular encoding scheme to provide a plurality of coded bits, and **Para 0026, 0048-0051**

wherein each transmission channel is capable of transmitting a particular number of information bits per modulation symbol via a particular modulation scheme selected for the transmission channel, **Para 0026, 0048-0051**

wherein each transmission channel is further associated with a particular coding rate based at least on the number of information bits per modulation symbol supported by the transmission channel and its modulation scheme, **Para 0026, 0048-0051**

wherein at least two transmission channels are associated with different coding rates, and **Para 0026, 00480051; table 1**

Li et al fails to teach the specific steps of puncturing and adjusting puncturing for different coding rates.

However, Hammons Jr meets the following limitations of the Claim:

to puncture the plurality of coded bits in accordance with a particular puncturing scheme to provide a number of unpunctured coded bits for the plurality of transmission channels, (**Column 1, Lines 46 to Column 2, Line 20**)

Art Unit: 2634

wherein the encoder is further configured to adjust the puncturing to achieve the different coding rates for the at least two transmission channels. **Claim 8; (Column 1, Lines 46 to Column 2, Line 20)**

Therefor it would have been prima facie obvious at the time the invention was made for Li et al's OFDMA system to use puncturing in order to adjust the coding rates. The motivation to combine is disclosed by Hammons Jr where he describes that the need for puncturing is "Due to data capacity limitations that may be present in certain communications networks, it is often necessary to decrease the rate and hence, the length, of a rate encoded data stream." (Column 1, Lines 46-51) Hammons Jr proceeds by describing how adaptive puncturing can be used for rate adjustment.

Regarding Claim 37, Hammons meets the following limitations of the Claims:

a channel interleaver coupled to the encoder and configured to interleave the plurality of coded bits, and wherein the encoder is configured to puncture the interleaved bits. **fig 1**

12. Claims 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al (US 20020119781 A1) in view of Hammons Jr (Us Patent 6,601,214) further in view of Gardner et al(US Patent#6,707,856) . Li et al and Hammons Jr meet all limitations of the Claim except disclosing the use of a signal mapping element.

However, Gardner et al discloses a signal mapper coupled to channel interleaver in an OFDM system. Gardner also meets the following last two limitations of the Claim:

to map each non-binary symbol to a respective modulation symbol, wherein each non-binary symbol includes a group of unpunctured coded bits. **(Column 5, lines 16-25)**

Gardner et al does not use a puncturer there the coded bits are also unpunctured.

Art Unit: 2634

Therefor it would have been prima facie obvious at the time the invention was made for Li et al's OFDMA system in combination with Hammons Jr to use a symbol mapping element. The motivation to combine is that this block is necessary in order carry out multi-point modulation schemes like 16 QAM.

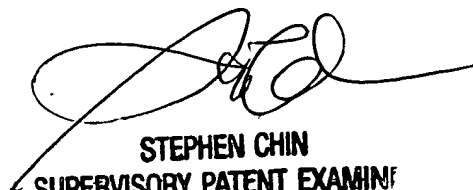
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry Vartanian whose telephone number is 703.305.8698. The examiner can normally be reached on 9-5:30 Mondays to Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on 703.305.4714. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Harry Vartanian
Examiner
Art Unit 2634

HV



STEPHEN CHIN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600